The Case for Application Defined Memory: Memory for Supercomputers

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Exascale research challenges relating to memory are mentioned in prior Exascale reports. Exascale OS/R (ExaOSR) could be using multiple memory media including both volatile and non-volatile memories in its memory-storage system. ExaOSR applications would be diverse with multiple memory access patterns. These memory access patterns, while using different memory media, would require different optimal configurations to save energy and to increase performance. ExaOSR needs to broker among multiple application requirements (or access patterns) and dynamically reconfigure multiple levels of memory sub-system. The results of this research would not only improve the supercomputers but also mobile/wearable computers and smartphones, where energy and performance are increasingly critical factors. System software and application developers would like to take advantage of these new possibilities to create a software stack that will allow applications to "*define their own memory*" behavior that will be efficient for their runtime.

- Challenge to be addressed:
  Irrespective of advances in photonics and material sciences (that might/not mature by 2020), what can be done by software to save energy and performance in moving data in and out of CPU or memory?